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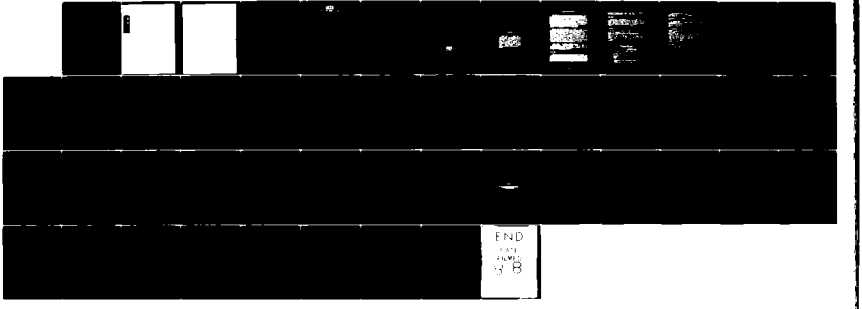

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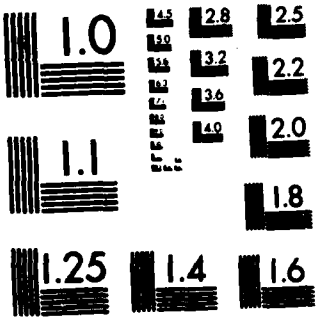

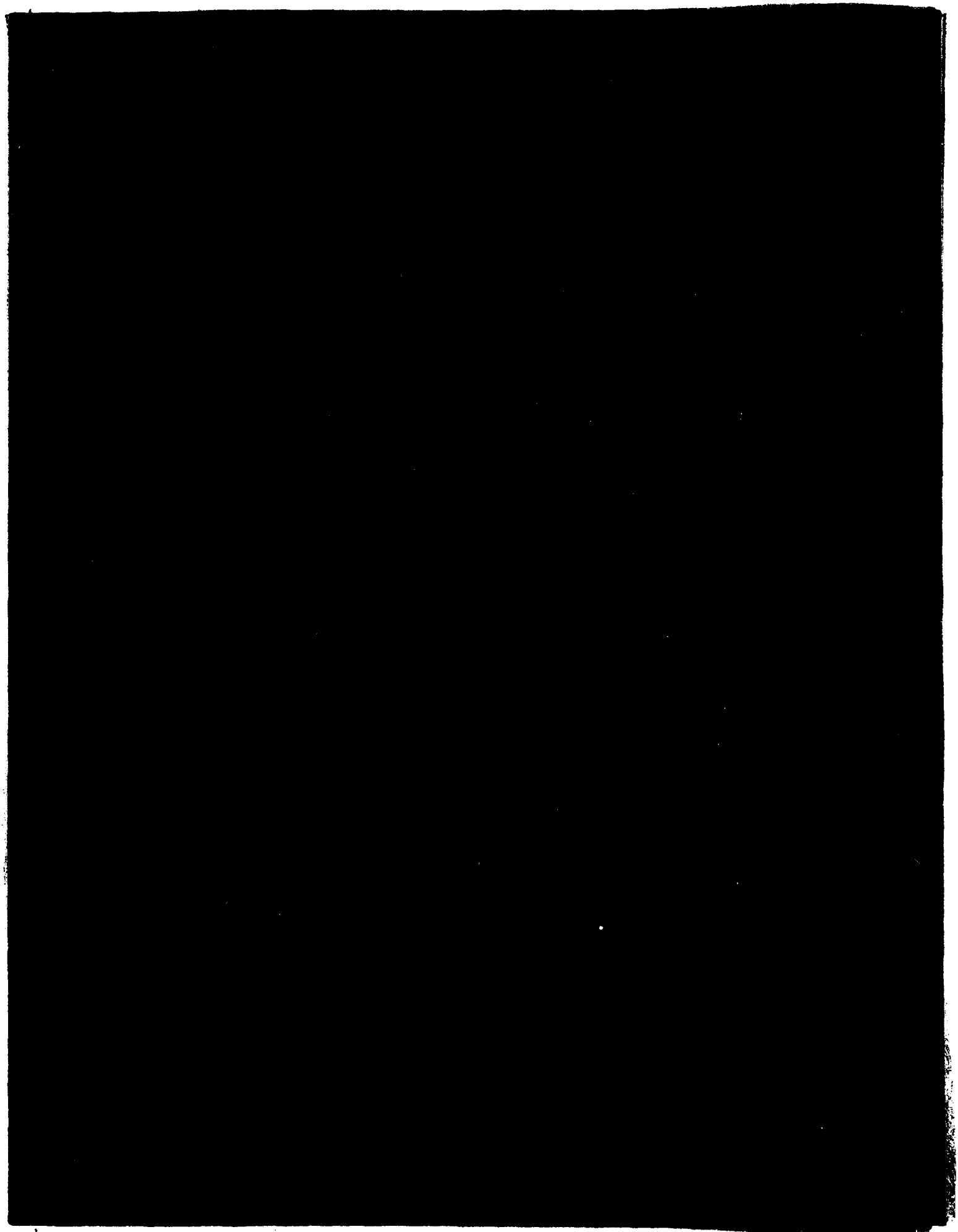

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Females tend to have higher performance than males in clerical and food services training courses, when aptitude scores are held constant. To help account for the differences, educational level and interest in clerical-type activities are included in this analysis, along with aptitude composite scores. A recommendation is made about adjusting aptitude qualifying scores for females.

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1. Enclosure (1) is forwarded as a matter of possible interest.

2. The Armed Services Vocational Aptitude Battery (ASVAB) is used by all branches of the armed services to measure the mental aptitudes of applicants for enlistment. The same ASVAB composites and qualifying scores are used to assign males and females to occupational specialty training. Equity in using the ASVAB for setting qualification standards implies that, holding aptitude scores constant, both males and females perform at the same level in training courses. This Research Memorandum examines this assumption and related policy issues.

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VALIDITY OF THE ASVAB FOR PREDICTING PERFORMANCE IN MARINE CORPS TRAINING COURSES: GENDER DIFFERENCES

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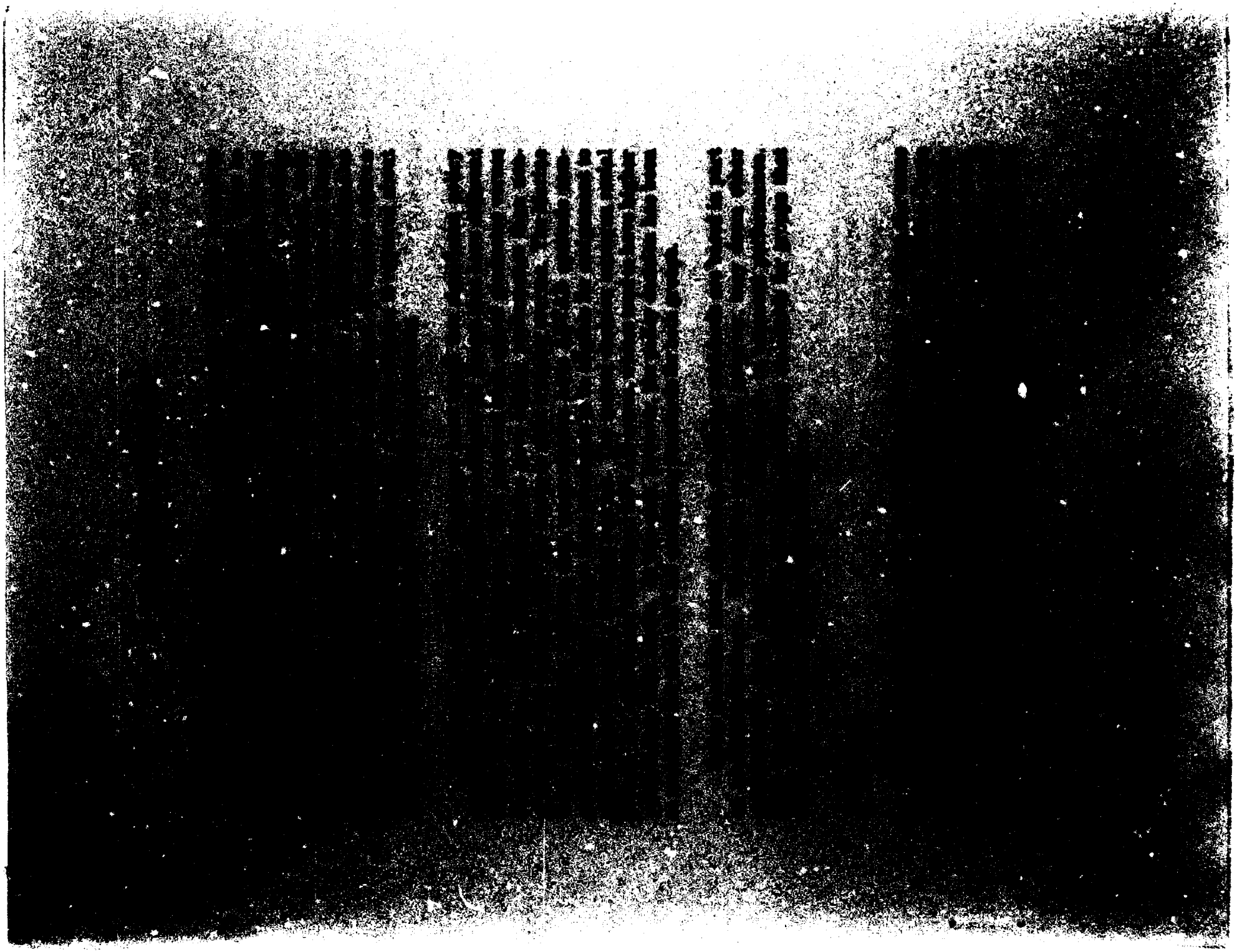

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PROBLEM

The Armed Services Vocational Aptitude Battery (ASVAB) is used to set qualification standards for assigning recruits to occupational specialty training courses. The same ASVAB qualifying standards are used for females and males. Equity in using the ASVAB for setting qualification standards implies that, holding aptitude scores constant, both sexes perform at the same level in the training courses. In most Marine Corps training courses, the expected performance, as predicted from ASVAB scores, of males and females does not differ significantly. However, in some training courses, the expected performance of females is significantly higher than for males; that is, with aptitude scores held constant, females outperform males in these courses [1, 2]. The difference in the relationship between ASVAB scores and training grades for the Administrative Clerk course is illustrated in figure 1.

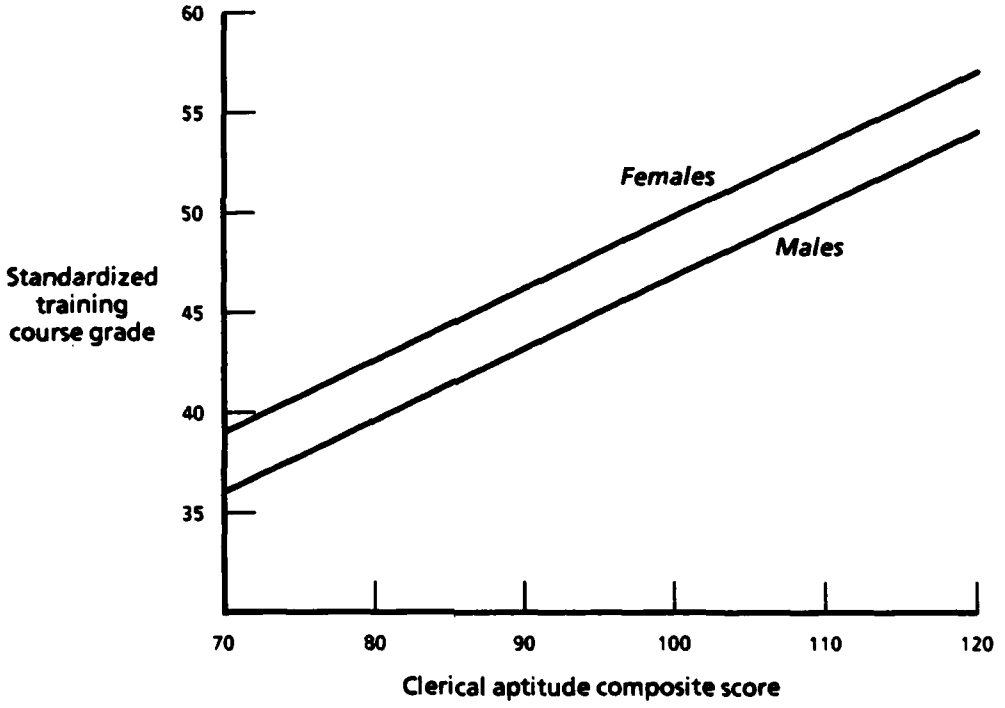


FIG. 1: DIFFERENCE IN EXPECTED PERFORMANCE BETWEEN FEMALES AND MALES IN THE ADMINISTRATIVE CLERK COURSE

The establishment of qualifying standards for Marine Corps training courses typically involves both technical analysis of the relationship between ASVAB scores and training grades and policy decisions by the manpower staff

of Marine Corps Headquarters. The policy decisions are informed by technical findings, but extra-technical factors may also enter. In the case of establishing qualification standards for different social subgroups, policy decisions are more complex than just considering the technical findings.

An example of a policy decision about standards that was driven largely by a technical finding is the requirement in the Marine Corps that people who did not graduate from high school need to have aptitude scores 10 points higher (one-half of a standard deviation) than graduates to qualify for assignment to occupational specialties. High school graduates quite consistently outperform nongraduates with the same aptitude scores [1, 2]. The additional 10 points required for nongraduates tends to equalize the performance of graduates and graduates who have minimum qualifying ASVAB scores. Although all military services have higher enlistment standards for nongraduates, only the Marine Corps has imposed the additional higher qualification standard for assigning nongraduates to occupational specialties.

An example of a policy decision that was governed primarily by extra-technical considerations is the requirement to have equal qualifying standards for all racial groups. The technical finding for Marine Corps training courses is that white students tend to outperform black students with the same aptitude scores [1, 2]. This result does not obtain in all courses, and occasionally the results even go in the opposite direction. The policy decision has been to maintain the same standards for all racial groups, even for courses where there is a consistent difference in predicted performance. Results of analyzing the effects of gender, educational level, and racial group on the prediction of training grades from ASVAB scores [2] are summarized in table 1.

The technical finding of differences in predicted performance between females and males does not require a policy decision to establish different standards. Extra-technical considerations may be deemed to outweigh the research findings, as in the case of racial groups, and the same standards can be maintained for both sexes.

The purpose of this analysis is to evaluate the equity of using the same ASVAB qualification standards for females and males in the Marine Corps clerical and food service courses. Differences in expected performance are most pronounced in these courses [2]. The analysis will evaluate to what extent educational level, racial group, and interest in clerical-type activities help account for differences in expected performance between the sexes. Based on the findings, a recommendation will be made about adjusting the ASVAB qualifying standards for females.

TABLE 1

EFFECTS OF GENDER, EDUCATION, AND RACE ON PREDICTING TRAINING COURSE GRADES FROM ASVAB SCORES

Grouping of specialties	Number of courses	Number of courses with significant differences					
		Gender[a]		Education[a]		Race[a]	
		Males	Females	HSG[b]	NHSG[b]	Whites	Blacks
Mechanical Maintenance	9	1	2	6	0	2	1
Clerical	7	0	2	5	0	1	0
Electronics Repair	3	0	0	3	0	0	1
General Technical	4	0	2	2	0	1	0
Combat	8	–	–[c]	1	0	3	0
Field Artillery	3	–	–[c]	2	0	1	0

a. Number of courses in which the labeled subgroup has the higher expected performance.
b. HSG = high school graduates; NHSG = nongraduates.
c. No females are assigned to Combat and Field Artillery specialties.

PROCEDURES

Interest is measured in two ways. One is through the training program enlisted for. Some Marine recruits enlist for training in a particular occupational area, such as the group of clerical specialties. Students in the clerical or food service training courses who requested training in these courses through the enlistment-guarantee program may be more highly motivated than those who were assigned to the courses at the convenience of the Marine Corps. The second way that interest is measured is through an interest inventory, which measures attentiveness to details, taken at the time of enlistment. The expectation is that by taking education, racial group, and interest into account, the differences in expected performance between females and males may be reduced.

Samples

The samples of Marine recruits were obtained from previous studies to validate the ASVAB as a predictor of final grades in occupational specialty training courses. One study was based on students attending courses in 1977-78 [1] and the other on students in 1981-82 [2]. In the former study, all

people had taken form 6 or 7 of the ASVAB (ASVAB 6/7), which includes the interest inventory. In the latter study, some people had taken ASVAB 6/7, but most had taken a new version of the ASVAB, forms 8, 9, and 10 (ASVAB 8/9/10), introduced on 1 October 1980. ASVAB 8/9/10 does not contain the interest inventory, and therefore people who took that version are not included in this analysis. Each course included in this study had at least 25 female students: Administrative Clerk, Stock Control, Communications Center Operator, and Food Service. Separate regression equations for males and females were computed only when the number of males or females in a course was 100 or larger.

Aptitude Composites

The aptitude composites obtained from the ASVAB are used to help set qualification standards for assigning recruits to occupational specialties. The Clerical (CL) aptitude composite is used for all courses in this analysis, except for Food Service, for which the General Technical (GT) aptitude composite is used. In this analysis, the CL composite contained the following ASVAB subtests: Word Knowledge, Math Knowledge, and Numerical Operations. The GT composite contained the Word Knowledge, Arithmetic Reasoning, and Mechanical Comprehension subtests.

Three dichotomous variables were also included in the analysis: educational level (high school graduate (HSG) versus nongraduate (NHSG)), enlistment guarantee (guaranteed training in the clerical or food service areas versus no relevant guarantee), and gender (female or male).

Statistical Analysis

The statistical analysis evaluated how similar the regression of training course grades on ASVAB scores is for females and males, while controlling for educational level, racial group, and interest. Evaluation of the similarity of regression has three components:

- The accuracy of prediction should be the same for all groups. When the distributions of grades and ASVAB scores are similar for the groups, the accuracy of prediction is shown by the validity coefficient. When the distributions are different, the accuracy of prediction must be measured by the standard error of estimate.

- The slope of the regression line should be the same for all groups. The slope is a measure of how much the predicted grades change as a result of a unit change in ASVAB scores or other predictors.

- The intercept of the regression line should be the same. The intercept shows the level of predicted grades.

When these three conditions are satisfied, the regression lines for the groups are homogeneous, and the personnel decisions for females and males based on ASVAB scores are equitable.

The linear model was used to evaluate the effects of gender on the prediction of training grades from aptitude scores, while controlling for racial group, educational level, and interest. Two regression equations were computed for each sample. The first equation was to determine the statistical significance of the interaction of the aptitude composite and interest inventory scores with gender, educational level, and enlistment guarantee. The full regression equation is as follows:

$$Y = b_0 + b_1 A + b_2 I + b_3 G + b_4 E + b_5 P + b_6 A \times G + b_7 A \times E + b_8 A \times P + b_9 I \times G + b_{10} I \times E + b_{11} I \times P + e \quad , \tag{1}$$

where

Y = training course grade
b_0 = regression constant
b_i = regression weight for variable i
A = ASVAB aptitude composite (CL or GT)
I = interest inventory
G = gender (1 for males, 0 for females)
E = education (1 for HSG, 0 for NHSG)
P = program enlisted for (1 for relevant guarantee, 0 for no relevant guarantee)
$A \times G, A \times E, A \times P$ = interaction terms between ASVAB scores and dummy $I \times G$, $I \times E, I \times P$ variables
e = residual error.

The interaction terms show the extent to which the slope of the regression of training grades on aptitude and interest inventory scores is different for the dichotomous dummy variables (gender, educational level, and enlistment guarantee). If the interaction effects are not statistically significant, then they can be dropped from the equation.

The additive regression equation without the interaction terms is as follows:

$$Y = b_0 + b_1 A + b_2 I + b_3 G + b_4 E + b_5 P + e \ , \qquad (2)$$

where the terms are defined as above. In the additive equation, the regression weights for the dummy variables reflect differences in intercepts for the categories of these variables.

Performance in the training courses was measured by final course grade. In this analysis, the failures in each course were assigned a grade that fell about one-half of a standard deviation below the minimum passing grade.

Separate regression equations were computed for each course in each data set (1977-78 and 1981-82), and for the pooled data for each course.

The rules for interpreting the regression weights are as follows:

- Weights without an asterisk are not statistically significant; those with a double asterisk have less than a 1 percent probability of occurring by chance; those with a single asterisk have less than a 5 percent probability of occurring by chance.

- Significant interaction terms mean that the slopes of the regression line are different for different levels of the dummy variable; that is, for one level of the dummy variable, there is a greater amount of change in predicted course grade for a unit change in aptitude or interest inventory scores. If an interaction term is significant, then the regression weight for the continuous variable (aptitude or interest inventory) and dummy variable cannot be interpreted directly. If the interaction terms are not statistically significant, they can be dropped, and the weights in the additive regression equations for the dummy variables can be interpreted directly as differences in intercepts.

- In the additive regression equation (equation 2),

  - A negative weight for gender means that females have higher predicted course grades; a positive weight that males have higher expected performance.

- A negative weight for education means that nongraduates have higher predicted course grades; a positive weight, graduates.

- A negative weight for guarantee means that people without a relevant guaranteed assignment have higher predicted course grades; a positive weight, people with a relevant guarantee.

- The weights show the unique effect of each variable; for example, if the weight for gender is significant, the difference holds, regardless of mean differences between the sexes in aptitude, interest, racial group, or educational level.

- The weights for aptitude and interest inventory scores cannot be compared directly to those for the dummy variables because they are on different scales. To find how many aptitude score points are equivalent to the effect of a dummy variable, divide the weight for a dummy variable by the aptitude weight and compare this number to the aptitude standard deviation of 20. For interest inventory scores, divide the dummy weight by the interest weight and compare to the interest inventory standard deviation of 3.

RESULTS

The three conditions required for homogeneity of regression will be evaluated: equal accuracy of prediction, equal slopes, and equal intercepts. These conditions are cumulative; for example, evaluating the equality of intercepts has meaning only if the slopes are equal for males and females.

Accuracy of Prediction

Table 2 shows the accuracy of predicting training grades from the ASVAB for males and females when the sample size was at least 100 cases. Validity coefficients[1] and regression weights are shown for the ASVAB subtests in the CL aptitude composite (Word Knowledge (WK), Math Knowledge (MK) and Numerical Operations (NO)) or GT aptitude composite (WK,

1. Correlation between training grades and the score on indicated ASVAB subtest.

TABLE 2

ACCURACY OF PREDICTION FOR MALES AND FEMALES

Sample	Gender	Validity coefficients			Regression weights[a]			Multiple correlation	Standard error of estimate	F ratio[c]
		WK[b]	MK[b]	NO[b]	WK	MK	NO			
Panel A:	Administrative Clerk									
1977-78	Females	.05	.46	.30	.08	.42**	.14**	.48	7.43	1.14
	Males	.24	.50	.35	.19**	.48**	.17**	.53	8.44	
1981-82	Females	.14	.38	.23	.06	.31**	.08	.39	6.01	1.46**
	Males	.30	.46	.31	.29**	.43**	.16**	.51	8.75	
Pooled	Females	.08	.44	.29	.08	.40**	.12**	.46	7.12	1.20**
	Males	.25	.49	.34	.20**	.47**	.17**	.52	8.52	
Panel B:	Stock Control									
1977-78	Females	.18	.41	.22	.23	.43**	.09	.44	8.05	1.01
	Males	.27	.55	.34	.19**	.56**	.13**	.57	8.15	
1981-82	Females[d]	--	--	--	--	--	--	--	--	--
	Males	.32	.56	.30	.25**	.67**	.07	.58	8.83	
Pooled	Females	.19	.42	.19	.20	.47**	.03	.43	8.08	1.06
	Males	.27	.52	.31	.17**	.53**	.10**	.54	8.58	

a. $p<.01$ shown by **; $p<.05$ shown by *.
b. ASVAB subtests are Word Knowledge (WK), Math Knowledge (MK), and Numerical Operations (NO).
c. F ratio is the ratio of the two standard errors of estimate for males and females for each course. $p<.01$ shown by **; $p<.05$ shown by *.
d. Inadequate sample size.

TABLE 2 (Continued)

Sample	Gender	Validity coefficients WK[b]	MK[b]	NO[b]	Regression weights[a] WK	MK	NO	Multiple correlation	Standard error of estimate	F ratio[c]
Panel C: Communications Center Operator										
1977-78	Females[d]	--	--	--	--	--	--	--	--	--
	Males	.34	.49	.35	.30**	.42**	.19**	.55	8.60	
1981-82	Females[d]	--	--	--	--	--	--	--	--	--
	Males	.24	.30	.29	.26*	.17	.27**	.38	9.59	
Pooled	Females	.15	.21	.03	.15	.18*	-.05	.25	6.41	1.38*
	Males	.32	.46	.34	.29**	.38**	.20**	.51	8.82	
Panel D: Food Service										
		WK[e]	AR[e]	MC[e]	WK	AR	MC			
1977-78	Females[d]	--	--	--	--	--	--	--	--	--
	Males	.14	.33	.41	.01	.27**	.38**	.45	9.01	
1981-82	Females[d]	--	--	--	--	--	--	--	--	--
	Males	.39	.50	.46	.14	.49**	.33**	.56	9.12	
Pooled	Females	-.01	.39	.21	-.07	.51**	.21	.42	8.68	1.05
	Males	.21	.37	.41	.07	.32**	.36**	.47	9.08	

e. ASVAB subtests are Word Knowledge (WK), Arithmetic Reasoning (AR), and Mechanical Comprehension (MC).

Arithmetic Reasoning (AR) and Mechanical Comprehension (MC)). The multiple correlation, with each subtest weighted according to the regression weights, is also shown. Because the two sexes have different distributions of ASVAB scores and training grades, the multiple correlation coefficients cannot be compared directly. The relevant statistic for comparing the accuracy of prediction is the standard error of estimate (SEest).[1]

In every case, the SEest is smaller for females than for males. The statistical significance of the differences is evaluated using the F ratio. In some cases, the accuracy of prediction is significantly higher for females (Administrative Clerk and Communications Center Operator). Note that even though the accuracy of prediction is always higher for females, as shown by the SEest, the multiple correlation coefficient may be higher, lower, or the same; in these courses, it is usually lower for females.

The accuracy of predicting training grades for females is equal to that for males or higher. Thus the statistical evaluation can proceed to the next step—equality of slopes.

Equality of Slopes

Weights for the full regression equation (equation 1), including the interaction terms, are shown in panel A of tables 3, 4, 5, and 6 for the Administrative Clerk, Stock Control, Communications Center Operator, and Food Service course, respectively. Also shown are the multiple correlations for the full and additive regression equation (panel B). None of the multiple correlations for the full and additive equations differ significantly ($p < .05$), which means that the interaction terms can be safely deleted and a common slope used for both levels of each grouping (gender, education, and guarantee). The number of cases in each group is shown in panel C of the tables.

Examination of the regression weights for the interaction terms in tables 3 through 6 shows that most of them are not significantly different from zero. The few that are did not maintain the same degree of difference in the 1977/78 and 1981/82 data sets. For example, in table 3 the aptitude-by-gender interaction term is significant in the 1981/82 and pooled data sets, but not in the 1977/78 set. In table 4, the interest-inventory-by-education interaction is

1. Use of the SEest obviates the need to correct the correlation coefficients for range restriction.

TABLE 3

FULL REGRESSION EQUATION WEIGHTS FOR THE ADMINISTRATIVE CLERK COURSE

Variable	Regression weight		
	1977-78	1981-82	Pooled
Panel A: Full regression equation			
Aptitude	.34**[a]	.26*	.34**
Gender	-9.32*	-24.79**	-12.52**
Education	5.82**	4.85	5.36**
Guarantee	1.46	-3.80	4.35
Interest	.38	-.37	.25
Aptitude x Gender	.06	.15*	.07*
Aptitude x Education	.00	-.03	.00
Aptitude x Guarantee	-.02	.00	-.05
Interest x Gender	.07	.52*	.17
Interest x Education	-.19	.09	-.15
Interest x Guarantee	.01	.19	.04
Panel B: Multiple correlation			
Full equation (Equation 1)	.59	.57	.59
Additive equation (Equation 2)	.59	.56	.58
Panel C: Number of cases			
Total	1,323	433	1,756
Females	457	145	602
Males	866	288	1,154
Graduates	1,040	387	1,427
Nongraduates	283	46	329
Guarantee	777	337	1,114
No guarantee	546	96	642

a. $p < .05$ shown by *; $p < .01$ shown by **.

TABLE 4

FULL REGRESSION EQUATION WEIGHTS FOR
THE STOCK CONTROL COURSE

Variable	Regression weight 1977-78	1981-82	Pooled
Panel A: Full regression equation			
Aptitude	.44**[a]	.44**	.44**
Gender	.00	13.84	.00
Education	12.24**	-21.64	13.13**
Guarantee	4.11	-1.66	-1.22
Interest	-.17	-.87	-.15
Aptitude x Gender	-.04	.00	-.03
Aptitude x Education	-.04	.00	-.08
Aptitude x Guarantee	-.07	-.01	.00
Interest x Gender	.39	-1.04	.27
Interest x Education	-.32*	2.16*	-.13
Interest x Guarantee	.40*	.31	.32
Panel B: Multiple correlation			
Full equation (Equation 1)	.60	.55	.55
Additive equation (Equation 2)	.60	.54	.54
Panel C: Number of cases			
Total	1,223	363	1,586
Females	115	25	140
Males	1,108	338	1,446
Graduates	860	345	1,205
Nongraduates	363	18	381
Guarantee	279	63	342
No guarantee	944	300	1,244

a. $p < .05$ shown by *; $p < .01$ shown by **.

TABLE 5

FULL REGRESSION EQUATION WEIGHTS FOR THE COMMUNICATIONS CENTER OPERATOR COURSE

Variable	Regression weight 1977-78	1981-82	Pooled
Panel A: Full regression equation			
Aptitude	.37**[a]	.35**	.39**
Gender	.00	.00	.00
Education	10.74	- 13.55	10.64
Guarantee	- 2.17	2.97	- 2.22
Interest	.38	- 1.13	.30
Aptitude x Gender	.01	.01	.01
Aptitude x Education	- .05	.00	- .06
Aptitude x Guarantee	.01	- .18	- .02
Interest x Gender	- .22	- .27	- .18
Interest x Education	- .15	1.10	- .13
Interest x Guarantee	.16	1.10*	.38*
Panel B: Multiple correlation			
Full equation (Equation 1)	.59	.45	.54
Additive equation (Equation 2)	.59	.45	.54
Panel C: Number of cases			
Total	696	184	880
Females	78	33	111
Males	618	151	769
Graduates	457	164	621
Nongraduates	239	20	259
Guarantee	241	116	357
No guarantee	455	68	523

a. $p<.05$ shown by *; $p<.01$ shown by **.

TABLE 6

FULL REGRESSION EQUATION WEIGHTS FOR THE FOOD SERVICE COURSE

Variable	Regression weight 1977-78	1981-82	Pooled
Panel A: Full regression equation			
Aptitude	.32***	.46**	.33**
Gender	.00	−.76	.80
Education	4.80	5.90	1.50
Guarantee	1.21	5.85	−1.23
Interest	.38	1.01	.50
Aptitude x Gender	.00	.00	.00
Aptitude x Education	.03	.02	.05
Aptitude x Guarantee	.00	−.08	.01
Interest x Gender	−.22	−.62	−.37
Interest x Education	−.45	−.66	−.40
Interest x Guarantee	.23	.35	.25
Panel B: Multiple correlation			
Full equation (Equation 1)	.47	.58	.49
Additive equation (Equation 2)	.47	.58	.49
Panel C: Number of cases			
Total	730	210	940
Females	90	29	119
Males	640	181	821
Graduates	359	159	518
Nongraduates	371	51	422
Guarantee	129	96	225
No guarantee	601	114	715

a. $p < .05$ shown by *; $p < .01$ shown by **

significant in both the 1977/78 and 1981/82 data sets, but in opposite directions (−.32 in 1977/78 and +2.16 in 1981/82); in the pooled data set the weight is not significant. The absence of consistent interaction effects means that the slopes may be taken as essentially equal and the analysis can proceed to evaluating the equality of intercepts.

Equality of Intercepts

The regression weights for the additive regression equations, which for the dummy variables are equal to the differences in intercepts, are shown in table 7. Two sets of weights are shown for each course. The first set is for aptitude and gender as the only variables in the equation. The second set includes all the variables in this analysis: gender, aptitude, education, race, guarantee, and interest.

TABLE 7

EQUALITY OF INTERCEPTS

Variable in equation	Regression weight[a]		
	1977-78	1981-82	Pooled
Panel A: Administrative Clerk course			
Two variables			
Aptitude	.42**	.38**	.41**
Gender	−3.55**	−2.95**	−3.41**
Five variables			
Gender	−2.41**	−2.49**	−2.39**
Aptitude	.36**	.34**	.36**
Education	3.67**	2.97*	3.64**
Guarantee	−.19	−1.34	−.35
Interest	.27**	.18	.25**
Panel B: Stock Control course			
Two variables			
Aptitude	.41**	.46**	.38**
Gender	−.33	−2.16	−1.26
Five variables			
Gender	.80	−.99	−.23
Aptitude	.37**	.44**	.35**
Education	5.08**	2.69	3.73**
Guarantee	1.79**	1.20	2.27**
Interest	.04	.29	.07

TABLE 7 (Continued)

Variable in equation	Regression weight[a] 1977-78	1981-82	Pooled
Panel C: Communications Center Operator course			
Two variables			
Aptitude	.41**	.26**	.38**
Gender	-2.56**	-2.85	-2.43
Five variables			
Gender	-1.68	-2.21	-1.60
Aptitude	.35**	.26**	.34**
Education	3.72**	-1.20	3.17**
Guarantee	.96	-3.11*	-.17
Interest	.15	.38	.22*
Panel D: Food Service course			
Two variables			
Aptitude	.33**	.42**	.44**
Gender	-2.39*	-7.76**	-3.63**
Five variables			
Gender	-1.99	-7.60**	-3.22**
Aptitude	.34**	.43**	.37**
Education	2.82**	1.50	2.34**
Guarantee	3.18**	1.51	2.05**
Interest	.00	.10	.02

a. $p<.05$ shown by *; $p<.01$ shown by **.

The first set of weights for each course—aptitude and gender—have larger weights for gender than the second set. The reason is that the first set does not take into account the effects of educational level, racial group, guaranteed training in a relevant specialty, and interest in attentiveness to details, whereas the second set does. To the extent that these variables are correlated with gender, they help attenuate the effects of gender shown in the first set of weights. The means, standard deviations, and intercorrelations for each sex in each course are presented in appendix A. Comparison of the two sets of weights shows that all gender weights moved in the positive direction (became smaller) when the other variables were added to the regression equation. These results show that educational level, race, and interest do help account for differences in expected performance between the sexes, but they do not eliminate them.

The interpretation of the gender weights in the second set is straightforward and is the primary focus of the analysis. These weights show the independent effects of gender—independent, that is, of the other variables in the equation.

The weight for gender in the Administrative Clerk course is significantly negative ($p<.01$) in all three data sets. The negative weights mean that females significantly outperformed males. In the other clerical courses (Stock Control and Communications Center Operator), however, the differences between the sexes, when controlling for the other variables, were consistently not significant. The trend in these courses was for females to outperform males, although in the Stock Control course 1977/78 data set, males outperformed females (weight is +.80). In the Food Service course, the gender weight was significantly negative in the 1981/82 data set and the pooled data, but not in the 1977/78 data set. Thus, a consistent difference between the training performance of the sexes in the Marine Corps is localized to the Administrative Clerk course.

The magnitude of the difference between the sexes in the Administrative Clerk course is approximately 2.5 points (in standard scores for grades), which is equivalent to one-fourth of a standard deviation in training grades. In the 1981/82 time period, the standard deviation of final course grades in the Administrative Clerk course taught at Camp Lejeune, which is where almost all of the females in this course are trained, was about 5 points (in percentage scores). Thus after controlling for the other variables, the difference in mean final course grade was about 1 1/4 points, where 75 was passing and 100 the highest score.

Another way of evaluating the magnitude of the difference between the sexes in the Administrative Clerk course is to convert the regression weight into equivalent aptitude composite scores. In the pooled data set, the gender weight was 2.39, and the Clerical aptitude composite weight was .36. The 2.39 thus is equivalent to 6.6 aptitude score points (2.39/.36), or one-third of a standard deviation on the aptitude composite score scale.

Examination of the regression weights for the other variables in the additive regression equation will help put the gender difference in proper perspective. The relevant aptitude composite (Clerical, except General Technical for the Food Service course) was a significant predictor in every data set. To the extent that training grades can be predicted from personal characteristics, most of the predictive validity is carried by aptitude test scores. High

school graduates tended to outperform nongraduates, as shown by positive weights for education. The only negative education weight was in the 1981/82 Communications Center Operator course (−1.20). As a rule, the effects for education were stronger than for gender.

The regression weights for the two interest variables (guarantee and interest inventory) did not have a consistent pattern. The interest inventory, which reflects attentiveness to detail, contributed to the prediction of course grades in the 1977/78 and pooled Administrative Clerk course. The weights for relevant guaranteed training was sometimes positive (people with a guarantee performed better) and sometimes negative (people without a guarantee performed better). The latter outcome is difficult to rationalize.

In sum, consistent differences in the expected performance of males and females were found only in the Administrative Clerk course. In this course, the difference in training grades was equal to about one-fourth of a standard deviation, which is the difference in performance expected from people whose ASVAB aptitude scores differ by 6.6 points (1/3 of a standard deviation). In the other two clerical courses, the sexes did not have different expected performance. In the Food Service course, a difference was found in one data set (1981/82), but not in both. The differences in training grades between the sexes are neither as pervasive nor as large as those observed between recruits of different educational levels.

DISCUSSION

This analysis of differences in expected performance for females and males has brought out three important facts about using the ASVAB to set qualification standards:

- ASVAB aptitude composites predict performance in training courses as accurately for females as males.
- The slopes of the regression equations for predicting performance are the same for females and males; that is, differences in aptitude scores have the same meaning for females and males.
- The level of expected performance does not have consistently significant differences between males and females, except in the Administrative Clerk course.

The conclusion is that, with the exception of the Administrative Clerk course, the ASVAB is equitable for both sexes. Personnel decisions based on the ASVAB conform to professional standards for using aptitude tests.

The difference in the intercepts for males and females in the Administrative Clerk course does require a decision about equity in setting qualification standards. The two options are as follows:

- Lower the minimum qualifying standards for females, or analogously, raise them for males.
- Do nothing.

In this section the implication of each option will be discussed, followed by a recommendation about which option to choose.

The function of adjusting the minimum qualifying standard is to equalize the expected performance of the two groups at the minimum qualifying scores.[1] The adjustment implied by the higher expected performance of females is illustrated in figure 2. The current minimum qualifying score is 100 on the Clerical aptitude composite. For convenience, the regression line for males intersects the pass-fail line at the minimum qualifying score. The regression line for females is displaced 6.6 Clerical aptitude composite scores to the left, which means that a qualifying score of 93.4 would be equitable for females. Conversely, the female minimum qualifying could have been drawn through 100, and the regression line for males then would have crossed the pass-fail line at a Clerical aptitude composite score of 106.6. Note that adjusting the minimum qualifying score would not remove the difference in performance at higher aptitude scores; all it would do is equalize the probability of failure at the minimum qualifying score.

1. The minimum qualifying aptitude scores are set at a level that as a rule will keep the course failure rate at no more than 10 percent of the student input. The qualifying aptitude score frequently is raised when the failure rate exceeds 10 percent input, and it may be lowered when the failure rate is far below 10 percent.

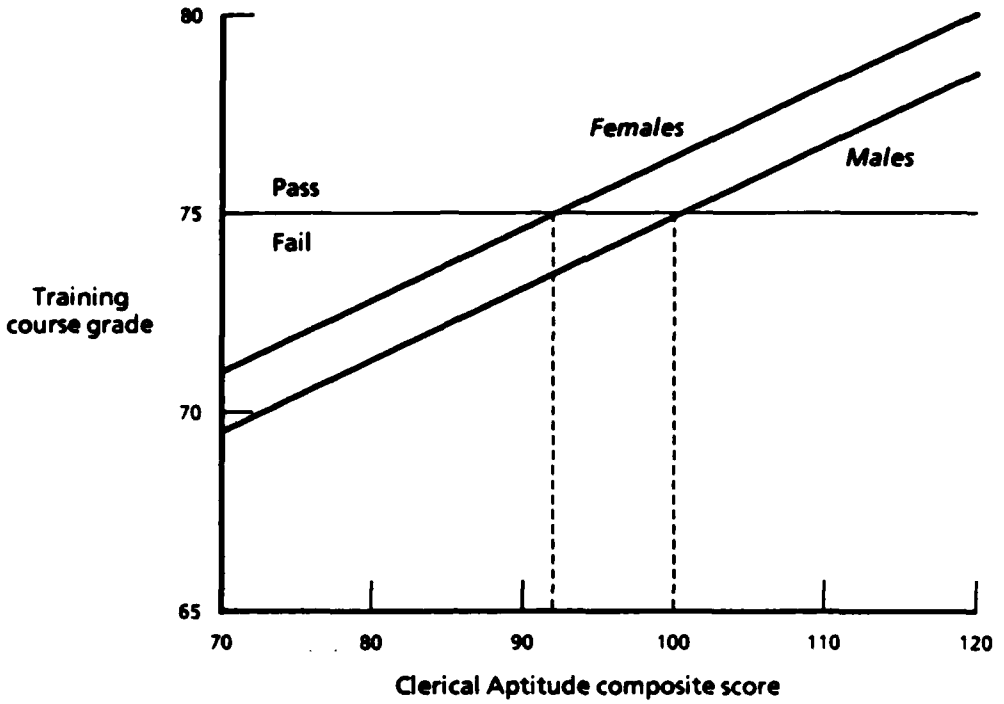


FIG. 2: REGRESSION OF TRAINING GRADES ON THE CLERICAL APTITUDE COMPOSITE SCORES FOR FEMALES AND MALES IN THE ADMINISTRATIVE CLERK COURSE

The effect of adjusting the qualifying score would be to qualify more females for the Administrative Clerk course. In the full 1981/82 data set [2] there were 1,669 females, of whom 975 (58 percent) were assigned to clerical specialties, and 502 (30 percent) were assigned specifically to the Administrative Clerk course. There were 2,058 students in the Administrative Clerk course in the 1981/82 data set, and of these 502 (24 percent) were females. Adjustments to the minimum qualifying standards would only serve to increase the proportion of females in this course.

Lowering the standard for females in the Administrative Clerk course would be counter to the concern for placing more females in nontraditional occupations. In addition, from the Marine Corps' point of view, increasing the percentage of female clerks could raise serious problems about assigning administrative clerks to combat units. If only males can be assigned to combat zones and a large proportion in the specialty were females, then rotating

people between combat and noncombat zones would become more difficult. Therefore, adjusting the qualifying standards would have undesirable consequences by channeling more females into a traditionally female occupation and by increasing the difficulty of rotating clerks in times of combat.

RECOMMENDATION

The existing qualification standards for assigning females and males to the Marine Corps Administrative Clerk course, and all other courses, should be retained.

REFERENCES

[1] CNA, Study 1160, *Validation of the Armed Services Vocational Aptitude Battery (ASVAB) Forms 6 and 7 With Application to ASVAB Forms 8, 9, and 10*, by William H. Sims and Catherine M. Hiatt, Feb 1981

[2] CNA, Report 102, *Validity of the Armed Services Vocational Aptitude Battery (ASVAB) Forms 8, 9, and 10 With Application to Forms 11, 12, 13, and 14*, by Milton H. Maier and Ann R. Truss, Feb 1985

APPENDIX A

MEANS, STANDARD DEVIATIONS, AND INTERCORRELATIONS FOR EACH COURSE

The means, standard deviations, and intercorrelations for each course are shown in tables A-1 through A-12. The variables are those in the additive regression equations: training course grade, gender, educational level, relevant guaranteed training, aptitude composite scores, and interest inventory scores. These statistics are the input to the additive regression equations.

TABLE A-1

STATISTICS FOR THE ADMINISTRATIVE CLERK COURSE IN 1977-78

	Mean	Standard deviation
Grade	49.99	9.99
Gender	.66	.48
Education	.79	.41
Guarantee	.59	.49
Aptitude	105.65	12.65
Interest	12.52	3.27

Number of cases = 1,323

Correlation:

	Grade	Gender	Education	Guarantee	Aptitude	Interest
Grade	1.00	- 0.32	.28	.09	.54	.22
Gender	- 0.32	1.00	- 0.29	- 0.00	- 0.32	- 0.22
Education	.28	- 0.29	1.00	.24	.19	.14
Guarantee	.09	- 0.00	.24	1.00	.09	.16
Aptitude	.54	- 0.32	.19	.09	1.00	.19
Interest	.22	- 0.22	.14	.16	.19	1.00

TABLE A-2

STATISTICS FOR THE STOCK CONTROL COURSE IN 1977-78

	Mean	Standard deviation
Grade	50.03	9.97
Gender	.91	.29
Education	.72	.45
Guarantee	.23	.42
Aptitude	101.81	13.18
Interest	11.14	3.29

Number of cases = 1,223

Correlation:

	Grade	Gender	Education	Guarantee	Aptitude	Interest
Grade	1.00	-0.16	.32	.25	.55	.16
Gender	-0.16	1.00	-0.13	-0.20	-0.28	-0.22
Education	.32	-0.13	1.00	.17	.17	.19
Guarantee	.25	-0.20	.17	1.00	.27	.25
Aptitude	.55	-0.28	.17	.27	1.00	.18
Interest	.16	-0.22	.19	.25	.18	1.00

TABLE A-3

STATISTICS FOR THE COMMUNICATIONS CENTER OPERATOR COURSE IN 1977-78

	Mean	Standard deviation
Grade	50.02	10.06
Gender	.89	.32
Education	.66	.48
Guarantee	.35	.48
Aptitude	101.92	13.38
Interest	11.30	3.31

Number of cases = 696

Correlation:

	Grade	Gender	Education	Guarantee	Aptitude	Interest
Grade	1.00	- 0.20	.33	.28	.55	.17
Gender	- 0.20	1.00	- 0.20	- 0.08	- 0.22	- 0.07
Education	.33	- 0.20	1.00	.29	.27	.17
Guarantee	.28	- 0.08	.29	1.00	.36	.29
Aptitude	.55	- 0.22	.27	.36	1.00	.17
Interest	.17	- 0.07	.17	.29	.17	1.00

TABLE A-4

STATISTICS FOR THE FOOD SERVICE COURSE IN 1977-78

	Mean	Standard deviation
Grade	50.04	10.06
Gender	.88	.33
Education	.49	.50
Guarantee	.18	.38
Aptitude	100.44	12.52
Interest	10.04	3.03

Number of cases = 730

Correlation:

	Grade	Gender	Education	Guarantee	Aptitude	Interest
Grade	1.00	-0.12	.17	.10	.42	.05
Gender	-0.12	1.00	-0.19	.12	-0.09	-0.23
Education	.17	-0.19	1.00	.16	.00	.19
Guarantee	.10	.12	.16	1.00	-0.09	.03
Aptitude	.42	-0.09	.00	-0.09	1.00	.02
Interest	.05	-0.23	.19	.03	.02	1.00

TABLE A-5

STATISTICS FOR THE ADMINISTRATIVE CLERK COURSE IN 1981-82

	Mean	Standard deviation
Grade	49.18	9.58
Gender	.67	.47
Education	.89	.31
Guarantee	.78	.42
Aptitude	102.15	13.18
Interest	12.49	3.21

Number of cases = 433

Correlation:

	Grade	Gender	Education	Guarantee	Aptitude	Interest
Grade	1.00	-0.33	.16	-0.06	.53	.18
Gender	-0.33	1.00	-0.18	-0.05	-0.39	-0.21
Education	.16	-0.18	1.00	.11	.08	.11
Guarantee	-0.06	-0.05	.11	1.00	-0.03	-0.01
Aptitude	.53	-0.39	.08	-0.03	1.00	.18
Interest	.18	-0.21	.11	-0.01	.18	1.00

TABLE A-6

STATISTICS FOR THE STOCK CONTROL COURSE IN 1981-82

	Mean	Standard deviation
Grade	48.53	10.68
Gender	.93	.25
Education	.95	.22
Guarantee	.17	.38
Aptitude	109.31	12.04
Interest	11.59	3.11

Number of cases = 363

Correlation:

	Grade	Gender	Education	Guarantee	Aptitude	Interest
Grade	1.00	-0.10	.15	.06	.52	.16
Gender	-0.10	1.00	-0.06	-0.16	-0.09	-0.22
Education	.15	-0.06	1.00	-0.06	.20	.02
Guarantee	.06	-0.16	-0.06	1.00	-0.01	.24
Aptitude	.52	-0.09	.20	-0.01	1.00	.12
Interest	.16	-0.22	.02	.24	.12	1.00

TABLE A-7

STATISTICS FOR THE COMMUNICATIONS CENTER OPERATOR COURSE IN 1981-82

	Mean	Standard deviation
Grade	49.20	9.99
Gender	.82	.39
Education	.89	.31
Guarantee	.63	.48
Aptitude	102.27	12.68
Interest	11.75	3.07

Number of cases = 184

Correlation:

	Grade	Gender	Education	Guarantee	Aptitude	Interest
Grade	1.00	-0.19	-0.00	-0.12	.34	.08
Gender	-0.19	1.00	-0.12	-0.01	-0.25	-0.21
Education	-0.00	-0.12	1.00	-0.09	-0.00	.11
Guarantee	-0.12	-0.01	-0.09	1.00	.02	.16
Aptitude	.34	-0.25	-0.00	.02	1.00	-0.09
Interest	.08	-0.21	.11	.16	-0.09	1.00

TABLE A-8

STATISTICS FOR THE FOOD SERVICE COURSE IN 1981-82

	Mean	Standard deviation
Grade	48.89	11.01
Gender	.86	.35
Education	.76	.43
Guarantee	.46	.50
Aptitude	97.94	13.46
Interest	10.63	2.75

Number of cases = 210

Correlation:

	Grade	Gender	Education	Guarantee	Aptitude	Interest
Grade	1.00	-0.25	.04	-0.07	.52	.14
Gender	-0.25	1.00	-0.23	.23	-0.02	-0.31
Education	.04	-0.23	1.00	.07	-0.16	.09
Guarantee	-0.07	.23	.07	1.00	-0.16	-0.04
Aptitude	.52	-0.02	-0.16	-0.16	1.00	.07
Interest	.14	-0.31	.09	-0.04	.07	1.00

TABLE A-9

STATISTICS FOR THE ADMINISTRATIVE CLERK COURSE IN THE POOLED DATA

	Mean	Standard deviation
Grade	49.79	9.89
Gender	.66	.48
Education	.81	.39
Guarantee	.63	.48
Aptitude	104.79	12.87
Interest	12.51	3.25

Number of cases = 1,756

Correlation:

	Grade	Gender	Education	Guarantee	Aptitude	Interest
Grade	1.00	- 0.33	.25	.05	.54	.21
Gender	- 0.33	1.00	- 0.26	- 0.01	- 0.33	- 0.22
Education	.25	- 0.26	1.00	.24	.15	.14
Guarantee	.05	- 0.01	.24	1.00	.05	.12
Aptitude	.54	- 0.33	.15	.05	1.00	.19
Interest	.21	- 0.22	.14	.12	.19	1.00

TABLE A-10

STATISTICS FOR THE STOCK CONTROL COURSE IN THE POOLED DATA

	Mean	Standard deviation
Grade	49.69	10.15
Gender	.91	.28
Education	.77	.42
Guarantee	.22	.41
Aptitude	103.53	13.31
Interest	11.24	3.26

Number of cases = 1,586

Correlation:

	Grade	Gender	Education	Guarantee	Aptitude	Interest
Grade	1.00	-0.15	.27	.21	.51	.15
Gender	-0.15	1.00	-0.11	-0.20	-0.23	-0.22
Education	.27	-0.11	1.00	.12	.21	.17
Guarantee	.21	-0.20	.12	1.00	.19	.24
Aptitude	.51	-0.23	.21	.19	1.00	.17
Interest	.15	-0.22	.17	.24	.17	1.00

TABLE A-11

STATISTICS FOR THE COMMUNICATIONS CENTER OPERATOR COURSE IN THE POOLED DATA

	Mean	Standard deviation
Grade	49.85	10.04
Gender	.87	.33
Education	.71	.46
Guarantee	.41	.49
Aptitude	101.99	13.23
Interest	11.40	3.26

Number of cases = 880

Correlation:

	Grade	Gender	Education	Guarantee	Aptitude	Interest
Grade	1.00	-0.19	.27	.18	.51	.15
Gender	-0.19	1.00	-0.19	-0.08	-0.22	-0.11
Education	.27	-0.19	1.00	.26	.23	.17
Guarantee	.18	-0.08	.26	1.00	.29	.27
Aptitude	.51	-0.22	.23	.29	1.00	.12
Interest	.15	-0.11	.17	.27	.12	1.00

TABLE A-12

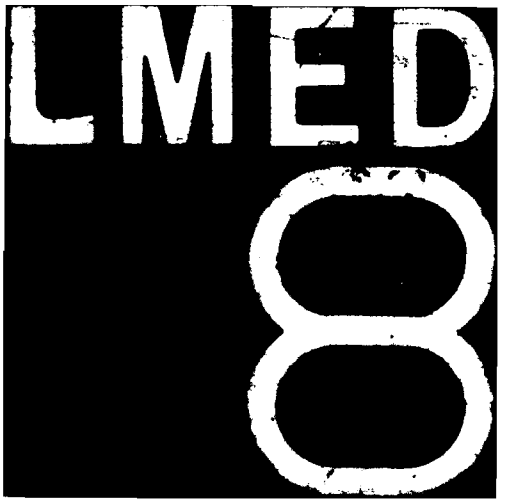
STATISTICS FOR THE FOOD SERVICE COURSE IN THE POOLED DATA

	Mean	Standard deviation
Grade	49.78	10.29
Gender	.87	.33
Education	.55	.50
Guarantee	.24	.43
Aptitude	99.89	12.77
Interest	10.17	2.98

Number of cases = 940

Correlation:

	Grade	Gender	Education	Guarantee	Aptitude	Interest
Grade	1.00	-0.15	.13	.03	.45	.07
Gender	-0.15	1.00	-0.20	.14	-0.07	-0.24
Education	.13	-0.20	1.00	.19	-0.05	.19
Guarantee	.03	.14	.19	1.00	-0.13	.04
Aptitude	.45	-0.07	-0.05	-0.13	1.00	.02
Interest	.07	-0.24	.19	.04	.02	1.00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